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F4S
(71) Applicants
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(54) **Plate-type heat transfer apparatus**

(57) In a heat transfer plate having therein a gasket groove 7 with a base and side walls, a compressible gasket 8 fitted into said groove has projections 10 protruding from its base surface and engaging in matching apertures 9 in the base of the gasket groove 7, whereby the gasket is mechanically secured to the plate in a readily releasable manner.

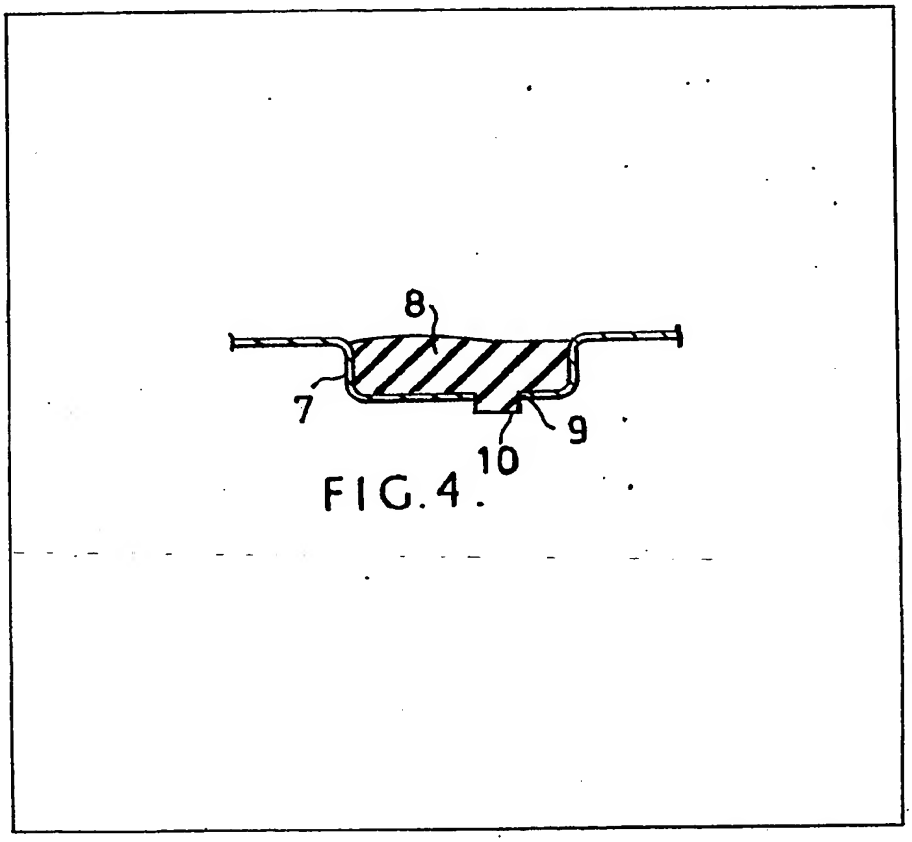

FIG.4.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

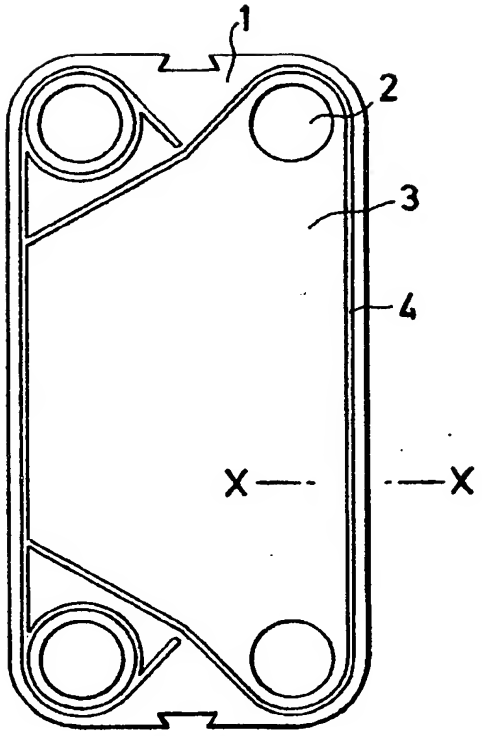

FIG. 1.

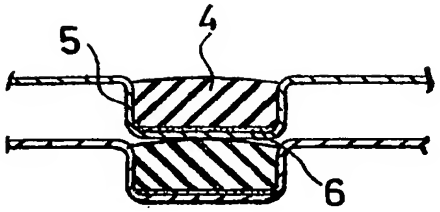

FIG. 2.

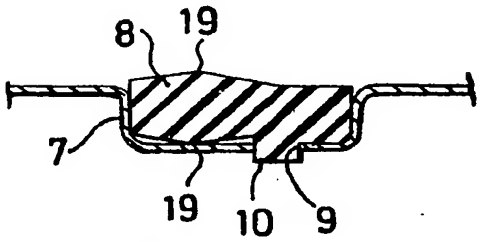

FIG. 7.

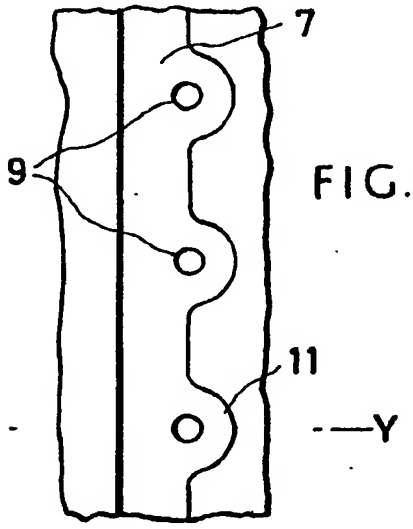

FIG. 3

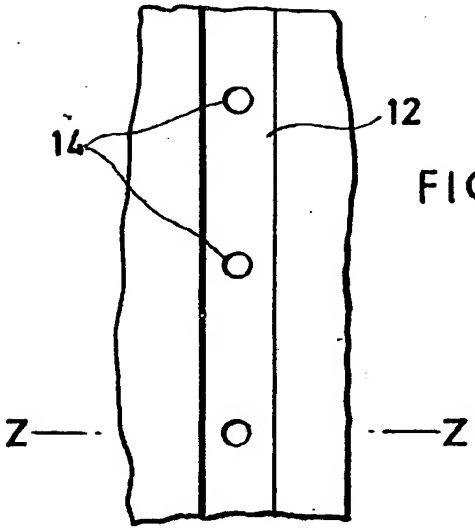

FIG. 5.

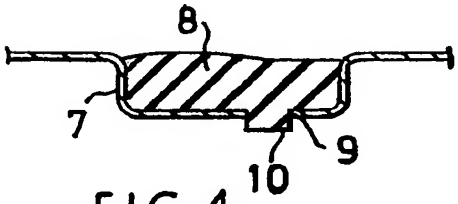

FIG. 4.

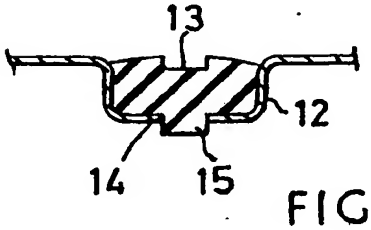

FIG. 6

SPECIFICATION

Improved heat transfer apparatus

This invention relates to plates for heat transfer apparatus, such as heat exchangers or evaporators.

In such heat transfer apparatus heat is transferred between two thin, broad streams, which may be both of liquid or one stream of liquid and one stream of vapour or two streams of vapour, or in some cases one or both streams may have mixed liquid and vapour phases. The streams are separated by plates assembled in a space face to face relationship to provide flow spaces between the adjacent faces of the plates. The boundaries of the flow spaces are enclosed and sealed by flexible or resilient gaskets surrounding the flow spaces between the adjacent faces and disposed between the flow spaces and entry and exit ports. The ports, in plate heat exchangers usually one at each corner of the plate, are similarly surrounded or part-surrounded by gaskets.

Each gasket is normally of a one piece construction set within a pressed groove formed in the plate. The manufacture of the gasket is normally carried out in moulds, but according to the size of the plate or the manufacturing techniques used the gasket may be assembled from two or more smaller components. The gaskets are normally moulded of an elastomeric material.

The sealing force against the fluid pressure in the flow space is obtained by compression of the gaskets in a direction normal to the plate surface and the resistance to gasket extrusion from the proper sealing position in the groove is normally enhanced by securing the gasket to the plate surface by the application of a system of adhesion. This system of adhesion is frequently complex and time consuming, involving the application of an adhesive to both the gasket and the plate surface, and assembly of the two components together. According to the system which is adopted it may be necessary to prepare the mating surface of either component before assembly and it may be necessary to subject the assembled components to a process designed for curing the bond after assembly.

The foregoing description covers the initial manufacturing process. It is common practice that as the elastomeric gasket material hardens and deforms in use with the passage of time, the servicing of the plate heat exchanger at the user's factory requires the replacement of the gasket. Removal of the old gasket requires destruction of the adhesive bond and cleaning of the groove. Also, it is not always possible to subject the newly assembled gasket to the optimum process of adhesion such as would be applied during initial manufacture by the supplier.

It is an object of the invention to provide mechanical engagement of the gasket with the plate so as to avoid the necessity for a system of adhesion.

It is well understood in industrial practice to form a seal groove in the face of one component, which groove has an opening smaller in dimension than the resilient gasket which has to be inserted through the opening. The gasket is thus releasably secured by its own resilience. Such a groove is difficult to form in a pressed plate in that it would not be readily produced in a one-hit pressing operation.

It is a known practice to attach a resilient gasket to an aperture in a substrate material by pushing somewhat oversize projections through the apertures. One particular use is in securing of gaskets to refrigerator doors. In such an arrangement, the loading on the gasket is light and the pressures involved are substantially atmospheric. However, it has not previously been suggested that a similar approach would be practicable with the gasket of plate heat transfer apparatus, where a pack of plates is compressed together and the gaskets are thus severely compressed in operation and also the pressure to be sealed may be very high. The sealing efficiencies of the gaskets are to some extent inter-dependent. In the case of plate heat exchangers it is normally necessary to glue the gasket to the metal component in order to minimise gasket movement which would result in leakage. Such movement can arise because changes in the loading condition of one gasket will alter the condition of the gasket on either side, and, perhaps of greater importance, the gaskets are assembled into the groove which is formed from then sheet material and which is therefore flexible.

According to a first aspect of the invention, there is provided a heat transfer plate having a gasket groove with a base and side walls, a compressible gasket mounted in the groove, the gasket being formed on its base with a series of spaced projections engaging in matching apertures in the base of the gasket groove.

According to a second aspect of the invention, there is provided a heat transfer apparatus comprising a pack of plates according to the invention as set forth above.

According to a third aspect of the invention, there is provided a compressible gasket for installation in a gasket groove in a heat transfer plate, the gasket comprising a base and side walls conforming with the gasket groove, in which the base of the gasket is provided with a series of spaced projections adapted to engage in matching apertures in the base of the gasket groove.

The invention will be further described with reference to the accompanying drawings, in which:—

Figure 1 is a plan view of a heat transfer plate of which the invention may be applied;

Figure 2 is a section on the line X—X of Figure 1;

Figure 3 is an elevational view of one form of gasket groove;

Figure 4 is an enlarged section on the line Y—Y of Figure 3, with the gasket added;

Figure 5 is an elevation of another form of gasket groove;

Figure 6 is an enlarged section on the line Z—Z of Figure 5 with the gasket added, and

Figure 7 is a view similar to Figure 4 showing a further modification.

Figure 1 shows an outline of a heat exchanger plate in which the plate 1 has the usual entry and exit ports 2 and the central heat transfer area 3 surrounded by a resilient gasket 4. As shown in Figure 2, which is a section XX through the gasket, the gasket 4 is mounted in a pressed groove 5 and attached to the plate by means of an adhesive layer 6, shown somewhat exaggerated in thickness.

In one well known form of plate design the gasket groove 7, as shown in Figure 3, is provided with lateral protuberances in the vertical wall as shown in 11. By this means the width of the gasket groove is locally enlarged as on section YY. It is proposed that at some or all of these enlargements the base of the rubber groove recess should be provided with a small hole 9, as shown in Figure 4. The gasket is manufactured with a series of small protuberances 10 which engage through the holes 9,

In a preferred form of the invention the holes 9 and protuberances 10 are manufactured to such dimensions that the protuberances will be slightly compressed when entering the hole so that the gasket and plate will remain assembled, but can be dis-assembled by pulling the gasket away from the plate.

It should be noticed that the wider portions of the gasket groove are normally positioned to alternate one with another from plate to plate, and thus in this embodiment the dimples 10 remain unaffected by compression when the plate pack is tightened to operable conditions, because the holes and dimples are well removed to one side of the sealing surface of the gasket.

Figure 7 shows a variation in which the gasket 8 is formed as a double peak gasket with the peaks shown at 18 and 19.

In an alternative form of the invention it is proposed that the hole and the dimple arrangement should be situated on or about the centre line of the gasket groove as shown in Figures 5 and 6 at 14 and 15. For this embodiment the dimple 15 of one gasket is allowed to protrude through the base of the gasket groove 12 and to engage in a recess 13 in the exposed face of the adjacent gasket. By this means adjacent gaskets will tend to be located and secured one to another throughout the plate pack and resistance to gasket extrusion caused by internal hydraulic pressure will be enhanced.

Various modifications may be made within the scope of the invention.

CLAIMS

1. A heat transfer plate having a gasket groove with a base and side walls, a compressible gasket mounted in the groove, the gasket being formed on its base with a series of spaced projections engaging in matching apertures in the base of the gasket groove.

2. A heat transfer plate as claimed in claim 1, in which one side wall of the gasket groove is formed with lateral undulations, so that the groove has wider portions, in which the apertures are formed in the base at the some or all of the wide regions.

3. A heat transfer plate as claimed in claim 2, in which the apertures are formed on or outside a line bounding the narrow portions of the groove.

4. A heat transfer plate as claimed in claim 1 or 2, in which the gasket is of the double peak form.

5. A heat transfer plate as claimed in claim 1, in which the gasket is formed with recesses in the exposed face, adapted to seal against the adjacent plate to receive the projections from the gasket in the groove in that plate.

6. A heat transfer plate substantially as hereinbefore described with reference to the accompanying drawings.

7. A heat transfer apparatus comprising a pack of plates as claimed in any of claims 1 to 6.

8. A compressible gasket for installation in a gasket groove in a heat transfer plate, the gasket comprising a base and side walls conforming with the gasket groove, in which the base of the gasket is provided with a series of spaced projections adapted to engage in matching apertures in the base of the gasket groove.

9. A gasket as claimed in claim 8, having lateral extensions along one side, the projections being formed on or in the region of some or all of the said lateral extensions.

10. A gasket as claimed in claim 9, which is of double peak form.

11. A gasket as claimed in claim 8, in which the face of the gasket adapted to seal against an adjacent plate is formed with recesses for receiving the projections on the gasket on that plate.

12. A gasket substantially as hereinbefore described with reference to the accompanying drawings.

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